

Ghost in-box architecture

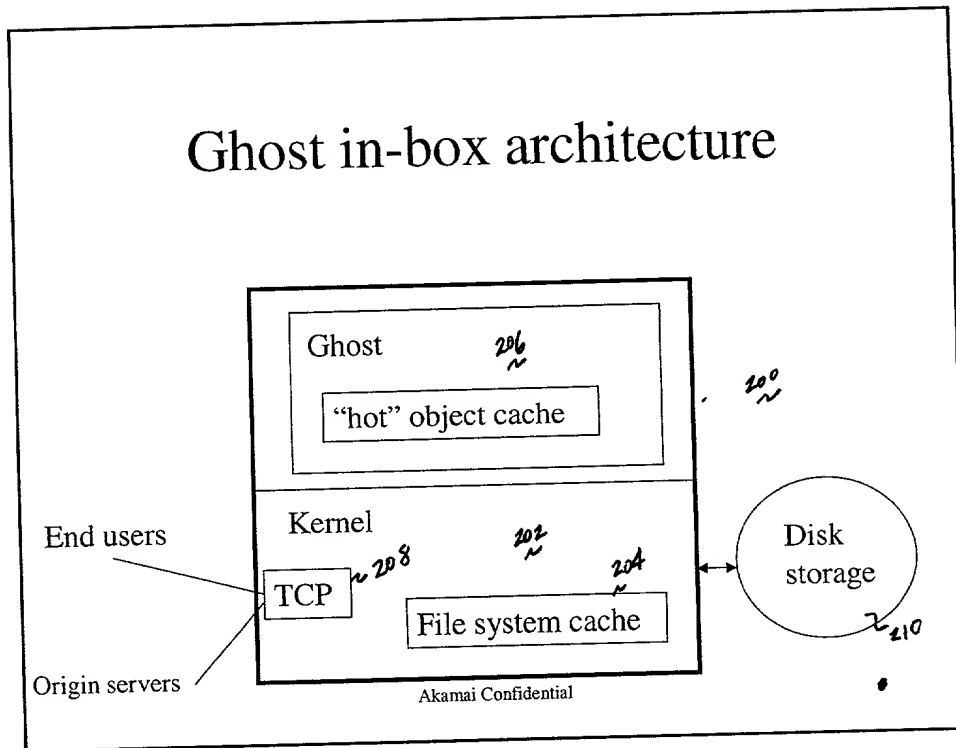


Figure 2

Region architecture

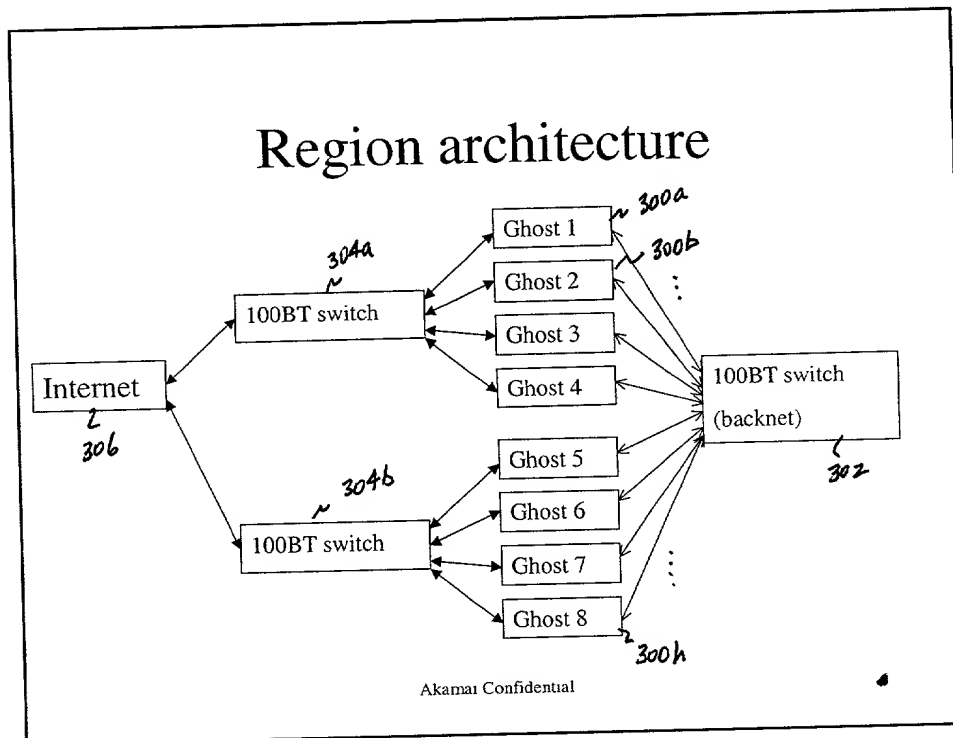


Figure 3

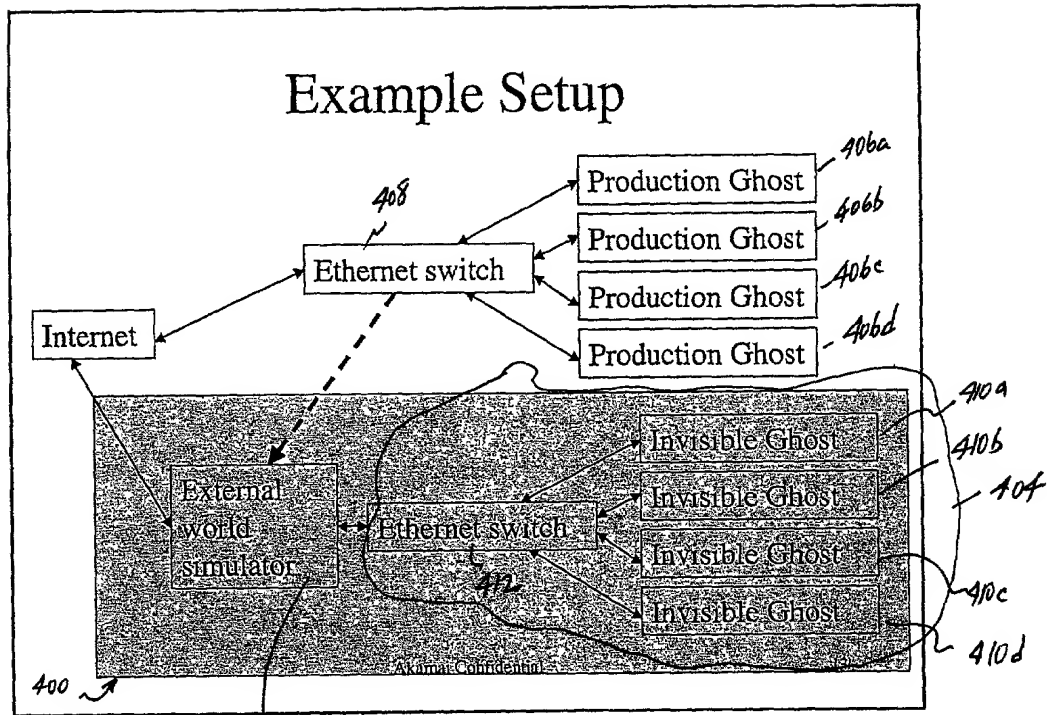


Figure 4

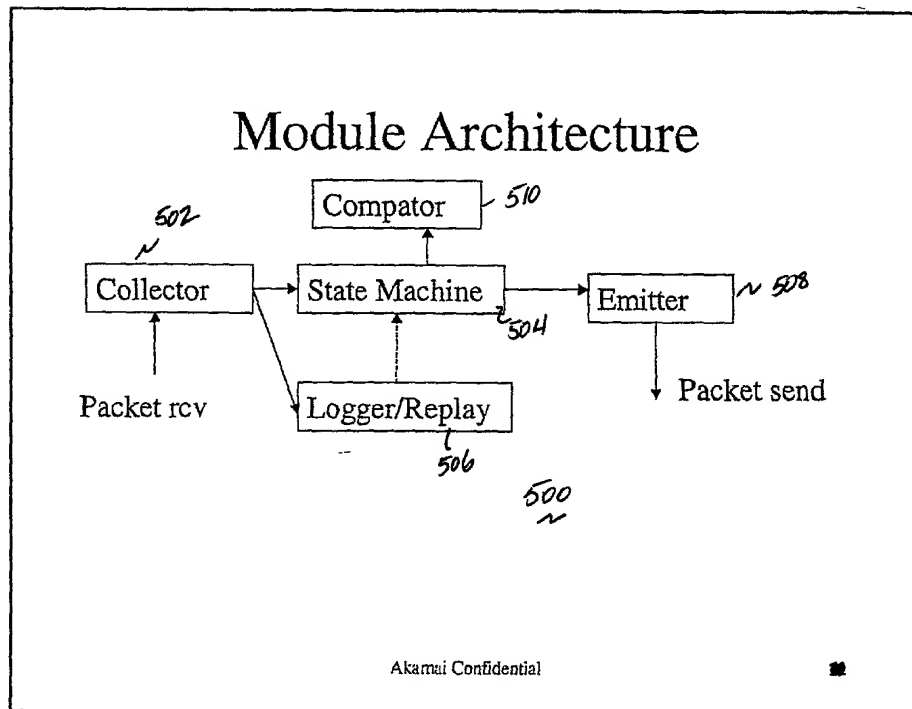


Figure 5

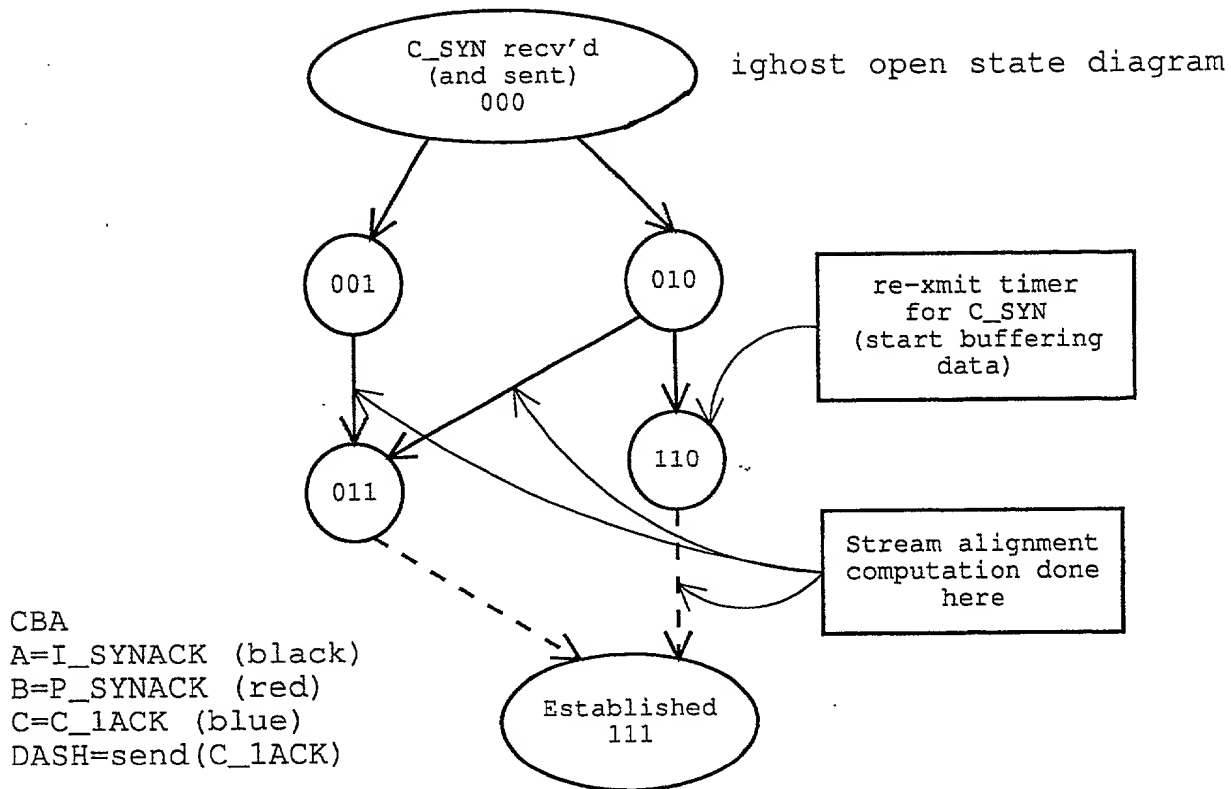


Figure 6

One connection in detail

Client - PG conversation

```

35.307723 client.2894 > PG.80: S 649812829:649812829(0) win 8192 id 37968
<mss 536>
35.307807 PG.80 > client.2894: S 2103996938:2103996938(0) ack 649812830
win 32736 id 22893 <mss 536>
35.394877 client.2894 > PG.80: . ack 1 win 8576 id 37989
35.402592 client.2894 > PG.80: P 1:405(404) ack 1 win 8576 id 37991
35.404046 PG.80 > client.2894: P 1:160(159) ack 405 win 32736 id 22902
35.404327 PG.80 > client.2894: F 160:160(0) ack 405 win 32736 id 22903
35.499080 client.2894 > PG.80: . ack 161 win 8417 id 38023
35.598546 client.2894 > PG.80: F 405:405(0) ack 161 win 8576 id 38049
35.598617 PG.80 > client.2894: . ack 406 win 32735 id 22925
  
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Figure 8

IGhost Close State Diagram

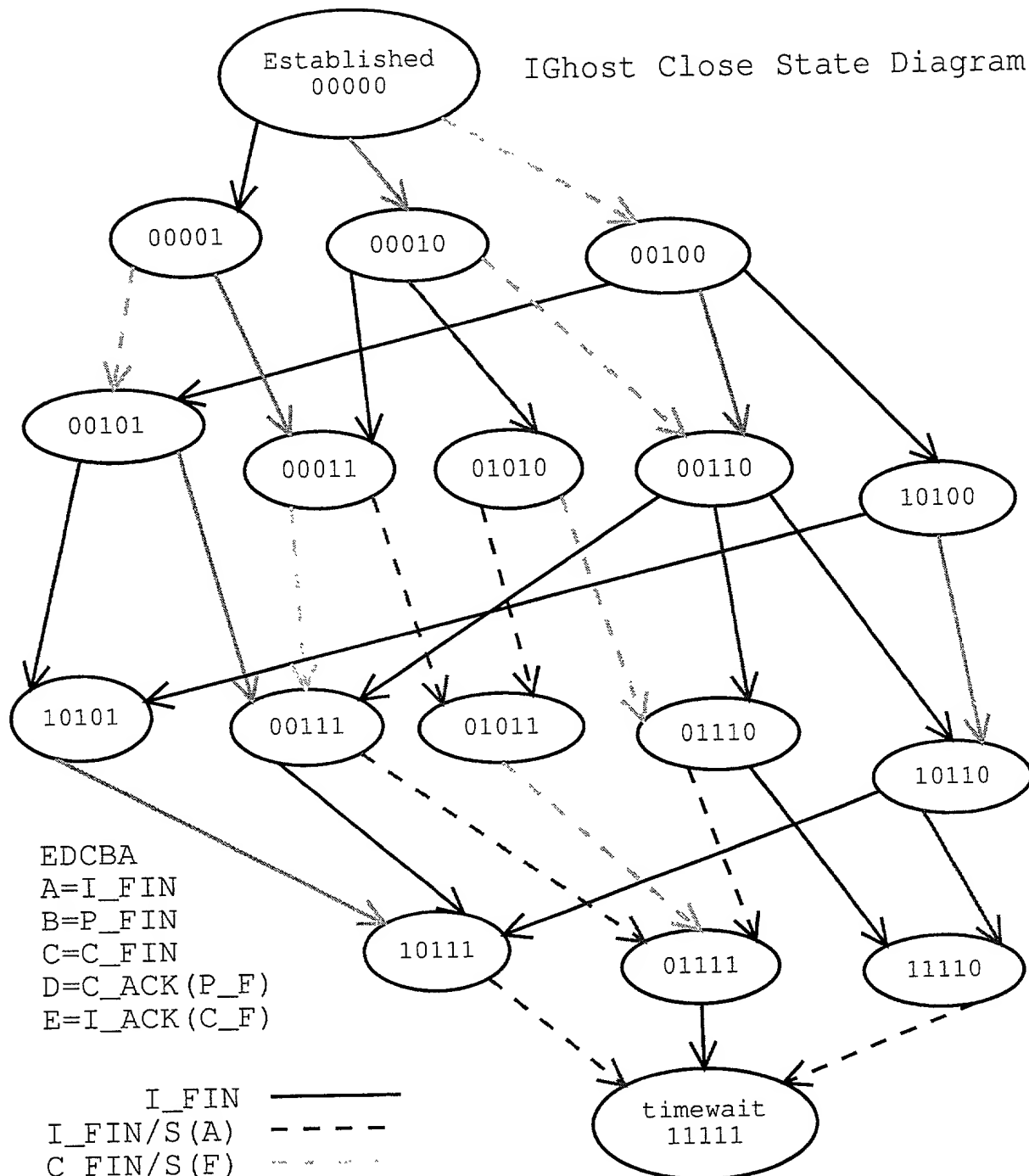


Figure 7

W/IG: connection open

35.307723 client.2894 > PG.80: S 649812829:649812829(0) win 8192 id 37968
<mss 536>

EWS duplicates client open

35.307864 client.2894 > IG.80: S 649812829:649812829(0) win 8192 id 37968
<mss 536> (ews)

35.307807 PG.80 > client.2894: S 2103996938:2103996938(0) ack 649812830
win 32736 id 22893 <mss 536>

Invisible Ghost responds to open

35.308005 IG.80 > client.2894: S 1396028487:1396028487(0) ack 649812830
win 32736 id 44202 <mss 536>

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Figure 9

W/IG: 1st ack and request

35.394877 client.2894 > PG.80: . ack 1 win 8576 id 37989

EWS duplicates client first ack, adjusting sequence numbers

35.394940 client.2894 > IG.80: . ack 1 win 8576 id 3750 (ews)

35.402592 client.2894 > PG.80: P 1:405(404) ack 1 win 8576 id 37991

EWS duplicates client request

35.402723 client.2894 > IG.80: P 1 405(404) ack 1 win 8576 id 37991 (ews)

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Figure 10

W/IG: Ghost responses

Invisible Ghost responds with 196 bytes

35.404068 IG.80 > client.2894: P 1:197(196) ack 405 win 32736 id 44209

Production Ghost with 159 bytes

35.404046 PG.80 > client.2894: P 1:160(159) ack 405 win 32736 id 22902

PG closes connection

35.404327 PG.80 > client.2894: F 160:160(0) ack 405 win 32736 id 22903

IG closes connection

35.404457 IG.80 > client.2894: F 197:197(0) ack 405 win 32736 id 44210

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Figure 11

W/IG: Ack generation

Client acknowledges data & FIN

35.499080 client.2894 > PG.80: . ack 161 win 8417 id 38023

EWS ack's data (rounding to packet boundary)

35.499146 client.2894 > IG.80: . ack 197 win 8381 id 3776 (ews)

EWS ack's FIN (blowing window open for drain)

35.540786 client.2894 > IG.80: . ack 198 win 65533 id 3778 (ews)

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Figure 12

W/IG: Connection Close

35.598546 client.2894 > PG.80: F 405:405(0) ack 161 win 8576 id 38049

35.598604 client.2894 > IG.80: F 405:405(0) ack 198 win 8576 id 38049 (ews)

35.598617 PG.80 > client.2894: . ack 406 win 32735 id 22925

35.598754 IG.80 > client.2894: . ack 406 win 32735 id 44216

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Figure 13

Compator Report

[[cmp start Wed Jan 12 04 44 14 2000]]

[c] (38 168 66 2 1283) headers (request 1)]

GET /71508/993/38267678/www.looksmart.com/vls99/ls-cats.gif HTTP/1.0

Accept: */*

Referer: <http://www.looksmart.com/eus1/eus65300/eus65303/eus77824/eus65079/eus327765/eus327766/eus318905/eus318610/r?l&>

Accept-Language: en-us

Accept-Encoding: gzip, deflate

User-Agent: Mozilla/4.0 (compatible; MSIE 4.01; Windows 95)

Host: a1508.g.akamai.net

[pg (38 187 87 201 80) headers (1) total_bytes 1982 body_bytes 1735]

HTTP/1.0 200 OK

Date: Fri, 12 Nov 1999 01:57:01 GMT

Server: Apache/1.3.4 (Unix)

Last-Modified: Mon, 09 Aug 1999 22:03:59 GMT

ETag: "a9c71-6c7-37af504"

Accept-Ranges: bytes

Content-Length: 1735

Content-Type: image/gif

Connection: close

[ig (38 185 125 201 80) headers (1) total_bytes 1903 body_bytes 1656]

HTTP/1.0 200 OK

Date: Wed, 12 Jan 2000 02:15:14 GMT

Server: Apache/1.3.4 (Unix)

Last-Modified: Wed, 11 Aug 1999 20:02:14 GMT

ETag: "7a939-678-37b1d5c6"

Accept-Ranges: bytes

Content-Length: 1656

Content-Type: image/gif

Connection: close

[msg] Differing response lengths

[[cmp end]]

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Figure 14